aring $2 bill versus $5 bill incen-
8;36:95.
ultman CI, Pope AR, et al. Case
l care for homeless addicted vet-
a true experiment. Med Care

hroyer LW, Grover FL, Hammer-
series monitors of outcomes: A
measuring quality of care. Med

s L, Lee A, et al. Comparing ge-
pecific measures of physical and
esults from the Veterans Health
98;36:155.
illo JE, Smith SC, Amézaga AM
aling (rehabilitation version): A
easuring progress of patients in
vidual rehabilitation goals. Med

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The Association Between Health Care Coverage and the Use of Cancer Screening Tests

Results from the 1992 National Health Interview Survey

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OBJECTIVES. The authors investigated whether utilization of six different cancer screening tests (mammography, clinical breast exam, Pap smear, Fecal Occult Blood Test, and Digital rectal exam) varied according to type of health care coverage.

METHODS. Data on the use of cancer screening tests and coverage in two age groups from a 1992 nationally representative cross-sectional survey of approximately 9,400 adults were analyzed. Multiple logistic regression analysis was used to estimate proportions of persons screened according to type and extent of coverage, adjusted for socioeconomic, demographic, and health status characteristics.

RESULTS. Persons aged 40 to 64 years with Medicaid coverage were equally as likely to receive five of six cancer screening tests as those with private fee-for-service coverage, and both groups were much more likely to be screened (70% higher for all six tests) than those who had no coverage. In contrast, persons aged 65 years and older who had supplemental private fee-for-service insurance in addition to Medicare were more likely to receive five of six tests than those with Medicare and Medicaid or those with Medicare only. For all six screening tests, managed care enrollees at all ages were approximately 10% more likely to be screened than persons enrolled in private fee-for-service plans. Fecal Occult Blood Test (25% versus 20%) and digital rectal exams (44% versus 38%) in persons aged 40 to 64 years and mammography (59% versus 48%) and Fecal Occult Blood Test screening (38% versus 30%) in the elderly were significantly more frequent for persons in managed care plans.

CONCLUSIONS. The extent of fee-for-service insurance coverage in the traditional indemnity US health care system was positively associated with the use of cancer screening tests. The authors found less difference in use of cancer screening between managed care and fee-for-service care in 1992 than we expected based on earlier research comparing use of preventive services in health maintenance organizations with fee-for-service care.

Key words: access to health care; health insurance; health maintenance organization; breast neoplasms; mammography; cervix neoplasms; Pap smear; colon neoplasms; fecal occult blood test; sigmoidoscopy. (Med Care 1998;36:257–270)

In the United States, third-party payer coverage shapes access to health care services. Less extensive health care coverage and greater out-of-pocket payments have been associated with less use of preventive services.[1-4] In addition to extent of coverage, screening also can vary according

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The authors dedicate this article to P. Ellen Parsons who recently passed away. The authors trust that her contributions to equity in health care for women and children and research on the fundamental role of social class in health status will be an inspiration to others to build on her work.

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to the organizational form of health services delivery. Researchers have argued that health maintenance organizations (HMOs) promote more frequent use of preventive services than fee-for-service (FFS) plans.[5] Before 1990, several studies had demonstrated that HMO enrollees were more frequently screened for cancer than FFS participants.[6–8]

Because health care is delivered in the United States through a free-market system, the extent of preventive services benefits can vary considerably depending on coverage. At the worst-off extreme, the 17% of Americans without health coverage who pay for services entirely out-of-pocket have faced an income barrier to receiving routine preventive care.[9] Individuals who lack any coverage, not even from public insurance programs like Medicare or Medicaid, are clearly at risk for not receiving recommended cancer screening services. At the other end of the spectrum, private FFS insurance may be more extensive than public FFS insurance in terms of coverage for preventive services, including cancer screening tests. Previous reports have shown that breast and cervical cancer screening is less likely in Medicare and Medicaid compared with private FFS plans.[10,11] There has yet to be a systematic examination of whether cancer screening varies according to the extent of FFS coverage. The first objective of this study was to examine the association between the extent of FFS coverage and the use of six separate screening tests for cancers of the breast, cervix, colon/rectum, and prostate. In 1997, these cancers were expected to account for approximately half of all new cases and for one fourth of cancer deaths.[12]

The RAND Health Insurance Experiment, which demonstrated the greater use of preventive services by an HMO in a randomized, controlled study, was completed more than a decade ago and included a single staff-model HMO.[1] Since then, there have been important market-driven changes in the health care system. Between 1980 and 1994, enrollment in managed care plans (excluding Preferred Provider Organizations [PPO]) increased from 4% to 16% of the US population, with Independent Practice Associations (IPA) the fastest growing form.[13] An increasing number of physicians have begun practicing in managed care organizations.[14] There has been almost no research on the newly emerging managed care system and the use of cancer screening tests. Therefore, our second objective was to compare the use of cancer screening tests in all managed care plans, including IPAs, PPOs, and traditional group and staff model HMOs, versus FFS insurance plans.

To assess both the extent of FFS coverage and differences between FFS and managed care plans, data from the 1992 National Health Interview Survey (NHIS) was used to estimate the proportions of the US population screened. The following screening tests were assessed: Pap smear, mammography, clinical breast exam (CBE), digital rectal exam (DRE), fecal occult blood testing (FOBT), and proctosigmoidoscopy (PRSIG). These tests are used, respectively, for screening for cancers of the cervix, breast, prostate, and colon and rectum and currently are recommended by the American Cancer Society and, except for DRE, by the US Preventive Services Task Force.[15–17] Mammography, Pap Smear, and FOBT screening have been related to reductions in mortality for cancers of the breast, cervix, and colon/rectum.[18–21]

Methods

The National Health Interview Survey (NHIS) is an annual in-person, cross-sectional, national survey of the civilian noninstitutionalized population conducted by the National Center for Health Statistics (NCHS) and US Bureau of the Census interviewers.[22] The Cancer Control Supplement was administered in 1992 to 12,035 respondents, selected via a complex, multistage sampling design. The Supplement asked about the awareness and use of several cancer screening procedures including how long, in years, since the most recent exam (see Appendix A). Persons who reported coverage by the US Armed Forces (either CHAMPUS, CHAMPVA, or VA) ($n = 188$) were excluded. Men aged less than 40 years, who were not asked about any of the screening tests ($n = 2354$), were excluded from all analyses of screening tests. Another 38 persons had missing insurance data, leaving a sample of 9,455 individuals. The minimum ages were 18 years for Pap smear and 40 years for the other five screening tests.

All analyses were done separately for those aged 65 years or older because of the nearly universal health coverage of the elderly by Medicare. We defined four categories of insurance coverage for each age group. For respondents aged 40 to 64 years, these were: persons enrolled in managed care plans (either HMOs consisting of prepaid group or staff model HMOs, IPAs, Network, Mixed models, or Exclusive or Preferred Provider Organizations (EPOs and PPOs)); persons with privately owned FFS insurance plans purchased

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Methods

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directly or through employers or unions; persons covered by Medicaid but not in managed care plans; and persons without any coverage. For persons aged 65 years and older, these categories included: those with Medicare coverage plus supplemental private FFS insurance plans; Medicare enrollees in HMOs or in PPOs; persons with Medicare plus Medicaid coverage; and persons with Medicare coverage only. Persons older than age 65 without Medicare coverage (<3%) were assigned to managed care or FFS depending on the type of private plan reported. The items used for the identification and measurement of health coverage are described in Appendix A.

For four screening tests (mammography, CBE, FOBT, DRE), dichotomous outcome variables were constructed to indicate whether the respondent reported being screened in the previous 2 years, which reflected professional recommendations and the possibility that annual check-ups occurred more than 12 months apart. For Pap smear and PRSIG, the interval was screening in the past 3 years because recommendations may be as infrequent as 3 years for Pap smears and PRSIG is recommended every 3 to 5 years. For each test, 5% to 10% of persons were excluded because they reported receiving that test for a health problem. Including persons with health problems did not change our results.

The use of each screening test according to health care coverage was evaluated by selected socioeconomic, demographic, and health status variables. Estimates of the unadjusted proportions screened in each of the coverage groups were tested for homogeneity across all four insurance groups using the omnibus chi-square test with three degrees of freedom to determine statistical significance.

Logistic regression models then were used to measure the proportions screened, adjusting for socioeconomic, demographic, and health status variables, with receipt of the screening exam (yes/no) within the intervals described previously as the dependent variable. In addition to type of health care coverage, we included age (continuous), race/ethnicity, gender, educational attainment, annual household income, marital status, and self-reported overall health status in all regression models. No two-way interactions between type of coverage and the other independent variables were found to be significant.

Output from the logistic regression models was used to calculate the adjusted proportion screened (with 95% confidence intervals) for each coverage group (managed care, FFS, Medicaid, None). This method directly standardized the proportions screened to the distribution of the covariates for the entire US population, which here was represented by the weighted NHIS sample.[23]

To examine the effect of extent of FFS coverage, two comparisons were performed for each screening test: private FFS was compared with Medicaid and Medicaid was compared with no coverage for persons aged 40 to 64 years. For those older than age 65, private FFS coverage was compared with Medicaid and Medicaid was compared with the group having Medicare coverage only because those with both Medicare and Medicaid have faced fewer financial barriers to receiving services. To compare types of plans, the managed care group was compared with the group having private FFS insurance. Significance tests of differences between the adjusted proportions were performed using *t* tests comparing the beta coefficients estimated from the logistic regression models, using a two-sided alpha level of 0.05. All analyses were weighted by the NHIS sample weights to the US total population and computed using SAS and the Survey Data Analysis statistical computer package (SUDAAN).[24]

Finally, logistic regression models were used to estimate the increase in breast and cervical cancer screening that would occur among uninsured women if reforms were implemented to provide all uninsured women coverage under either Medicaid (FFS) or managed care. In this "what-if" scenario, we calculated the change in the proportion of uninsured women who would have been screened if their coverage had been different. With this procedure, the uninsured women retained all of their social, demographic, and health status characteristics that were included in the screening model.

Results

Table 1 shows the distribution of health insurance coverage among all persons responding to the 1992 NHIS Cancer Control Supplement according to age and gender. The percentage of persons enrolled in managed care plans (including PPOs and EPOs) was much higher (23%) for those younger than age 65 versus those older than age 65 (14%). The percentage of those aged 40 to 64 years without any coverage (14%) was

TABLE 1. Distribution of Health Care Coverage (% Weighted to US Total Population) According to Age and Gender, 1992 NHIS Cancer Control Supplement (n = 12,035*)

	Managed Care	Private FFS	Medicaid†	No Coverage
Ages 18–39 yr				
Males (n = 2,354)	21.4	48.5	3.9	26.2
Females (n = 3,038)	22.9	46.3	10.1	20.7
Ages 40–64 yr				
Males (n = 1,819)	23.1	57.4	5.0	14.5
Females (n = 2,362)	23.3	56.4	6.2	14.1
	Medicare + Managed Care	Medicare + FFS Plan	Medicare + Medicaid	Medicare Only
Ages ≥65 yr				
Males (n = 795)	13.9	66.6	4.5	15.0
Females (n = 1,441)	14.8	61.4	6.9	16.9

FFS, fee-for-service.

Note: Rows add to 100%.

*Excludes persons with military coverage (n = 188) and persons with missing insurance status (n = 38). Less than 3% of persons ages 65 and over who did not report Medicare coverage were included in either managed care or FFS depending on their private coverage.

†Medicaid category also includes persons with other public assistance programs for health coverage.

similar to the percentage of those 65 years and older with Medicare coverage only (16%).

An examination of the distribution of all independent variables according to type of health coverage showed differences in the distribution of sociodemographic, socioeconomic, and health status variables for different coverage groups (data not shown). Persons younger than age 65 with Medicaid coverage were generally younger, reported lower incomes and less education, and were more frequently female and nonwhite compared with persons with private health coverage. Younger persons with Medicaid or no coverage reported worse overall health status than those in either FFS or managed care plans. Managed care and FFS enrollees younger than age 65 were similar with respect to education and income, whereas among those aged 65 years and older, managed care enrollees had somewhat higher incomes and more education than those with supplemental FFS coverage. Self-reported health status was similar between these two groups. Those with Medicare only, or with Medicare and Medicaid coverage, reported poorer health status and lower incomes than those elderly with managed care or FFS coverage.

Table 2 shows the unadjusted proportion of persons screened by age, race, education, and income among persons younger than 65 years and aged 65 years and older, respectively. Screening varied by age, education, and income level, but not much by race/ethnicity. Being currently married with spouse in household was significantly positively associated with use of cancer screening tests. Younger women reporting fair or poor overall health status were less likely to report having had a recent mammogram or Pap smear than those reporting good or excellent health, but no differences in screening were observed according to health status among elderly women (data not shown).

Type of Fee-For-Service Coverage and Screening

Table 3 shows the unadjusted proportions screened according to coverage. Overall, screening was highest for Pap smear, CBE, and mammography. For all six tests studied, screening was most likely in managed care, followed by private FFS plans, Medicaid, and least likely in the no coverage group.

The unadjusted screening proportions (Table 3) demonstrate the associations between different

otal Population) According to Age
nt (n = 12,035*)

edicaid†	No Coverage
3.9	26.2
10.1	20.7
5.0	14.5
6.2	14.1
edicare + edicaid	Medicare Only
4.5	15.0
6.9	16.9

insurance status (n = 38). Less than
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types of FFS coverage and the use of cancer screening tests. Among persons aged 40 to 64 years (except Pap smear, which included women 18–64 years), screening was most likely among persons with private FFS coverage, followed by those with Medicaid, and least likely among those without any coverage. For persons aged 65 years and older, smaller differences were observed between the Medicare-plus-Medicaid group versus those with Medicare only.

In Table 4, the estimates of screening proportions are shown after adjusting for age, race, education, income, marital status, health status, and gender where applicable. (Appendix B contains odds ratios from associated logistic regression models.) Screening was more likely for all tests except PRSIG in the Medicaid group relative to the no coverage group; averaging across all exams, screening was approximately 70% higher in the Medicaid group than in the no coverage group. Moreover, screening was no more likely in private FFS plans than in Medicaid. Women aged 18 to 64 years covered by Medicaid were more likely to report having had a Pap smear in the previous 3 years (87% versus 80%, $P < 0.001$). Both mammography (58% versus 54%) and CBE (74% versus 65%) were not significantly higher in private FFS plans compared with the Medicaid group.

We observed a different pattern in those aged 65 years and older (bottom of Table 4). Unlike the younger age group, screening was more likely among those with private FFS coverage compared with those with Medicare and Medicaid. On average, screening was approximately 60% higher across all six tests in the group with private FFS coverage. The combination of Medicaid and Medicare, however, did not appear to offer any advantage in terms of cancer screening over those with Medicare only. There were no statistically significant differences observed between these two groups for any tests. Higher screening in the Medicare plus Medicaid group with mammography (34% versus 29%), CBE (49% versus 41%), and Pap smears (43% versus 36%) were counterbalanced by lower screening with FOBT, PRSIG, and DRE; however, none of these differences were significant.

Comparing Managed Care and Fee-for-Service

Unadjusted comparisons in Table 3 shows screening was consistently higher in managed care plans compared with all of the FFS groups. Table 4 contains the proportions screened in both groups after adjustment for social, demographic, and health status characteristics. This adjustment tended to shrink differences between managed care and private FFS much more in the older groups than in the younger groups, indicating greater underlying population differences between the two coverage groups in the older age groups and confirming our bivariate analyses.

Table 4 shows that screening was more likely in managed care than in private FFS plans for 10 of 12 comparisons shown, but only four were significantly different. Screening for all six cancers was approximately 10% greater in managed care than in FFS plans in both age groups. Fecal Occult Blood Test was significantly more common both for the younger age group (25% versus 20%, $P < 0.01$) and in older respondents (38% versus 30%, $P < 0.01$). Digital rectal exam was more likely for those in managed care in the younger group (44% versus 38%, $P < 0.01$), but not the older group. Mammography screening was significantly higher in managed care plans compared with private FFS plans for women aged 65 years and older (59% versus 48%, $P = 0.02$), but not among women aged 40 to 64 years.

Discussion

Our first objective was to characterize cancer screening according to the extent of FFS insurance coverage. A new finding is that, among those aged 40 to 64 years, the use of cancer screening exams was not greater among those with private FFS insurance compared with those with Medicaid. In contrast, private FFS coverage was associated with higher use of cancer screening than public FFS coverage among older persons. This may be partly explained by the fact that most supplemental FFS insurance plans provide coverage for Medicare co-payments and deductibles, thus removing a potential income barrier to screening. Our findings for six separate cancer screening tests are consistent with a previous survey of Medicare enrollees that demonstrated that women with private FFS insurance coverage were more likely to receive mammography screening than women with Medicare-only coverage.[11]

As expected, persons younger than age 65 without coverage received fewer preventive services than those with FFS coverage, particularly in lower income groups.[3,9,25] For example, insured women were more likely than uninsured women to obtain breast and cervical can-

TABLE 2. Unadjusted Estimates of Screening Use (% Weighted to US Total Population) According to Selected Sociodemographic Characteristics, 1992 NHIS

	Mam (n = 2,093)	CBE (n = 2,130)	Pap* (n = 4,794)	FOBT (n = 3,753)	PRSIG (n = 3,858)	DRE (n = 3,593)
18–64 yr of age						
Age						
18–29	NA	NA	82.3	NA	NA	NA
30–39	NA	NA	84.3	NA	NA	NA
40–49	55.8	74.1	81.0	14.5	5.3	34.6
50–64	56.3	68.4§	70.5†	26.2†	10.0†	39.3§
Race/ethnicity						
White NH	57.1	71.9	79.9	21.1	7.7	39.1
Black NH	56.5	71.2	85.6	19.6	9.7	31.4
Hispanic	51.3	73.7	78.1‡	12.9‡	6.0	23.0†
Education						
<12 yr	38.4	57.9	65.9	14.8	5.4	24.1
HS graduate	53.5	69.4	77.1	18.4	6.4	34.9
>12 yr	66.9†	79.6†	87.5†	24.2†	9.7‡	43.9†
Household income						
<20,000	38.9	59.0	73.0	14.3	5.5	23.2
≥20,000	62.0†	75.6†	82.8†	22.0†	8.2‡	40.9†
Currently married						
Yes	57.9	72.9	82.8	21.8	8.0	38.4
No	51.6§	67.2§	74.7†	16.2†	6.6	32.6‡

(*Continues*)

cer screening exams, consistent with earlier research[26–28]; lower screening rates may contribute to the higher breast cancer mortality reported in the uninsured.[29]

Our second objective was to assess differences in screening between managed care and FFS plans. Overall, screening was only 10% higher, on average, in managed care plans across the six tests in either age group. Differences were not as large as expected from earlier studies, which typically included traditional prepaid staff or group model HMOs.[1,6–8] In the early 1990s, managed care plans continued to demonstrate a consistent pattern of more screening than private FFS plans, but only four tests were significantly higher in managed care. The results for FOBT and DRE screening may have been due in part to their easier inclusion in annual physical examinations, which may be more frequent in some forms of managed care plans.[8] Further, several early reports about the benefits of screening for colorectal cancer by investigators at one large prepaid group practice HMO may have stimulated the early adoption of FOBT into routine preventive care in some managed care plans.[30–32]

These results raise the question whether the rapid growth of the for-profit managed care industry is narrowing the historically greater differences between managed care and FFS plans in provision of preventive services. Certain organizational features of long-established, traditional managed care plans may be conducive to higher screening rates. For example, physicians in staff and prepaid group model HMO plans may have greater access to plan-based reminder systems to conduct outreach activities compared with FFS physicians.[33,34] Additionally, these plans often develop and implement centralized systems to deliver preventive services rather than rely on individual providers.[35] This may be one of the reasons contributing to the higher use of mammography screening among the elderly in managed care plans compared with FFS plans. Such features, however, may not have been present in the fastest growing forms of managed care in the

TABLE 2. (Continued)

	Mam (n = 1,296)	CBE (n = 1,300)	Pap (n = 1,337)	FOBT (n = 1,939)	PRSIG (n = 1,936)	DRE (n = 1,827)
≥65 yr of age						
Age						
65–69	54.4	70.9	62.9	29.0	13.0	43.5
70–79	47.2	56.9	51.2	29.9	12.3	37.1
80+	28.1[†]	44.0[†]	36.1[†]	20.8[§]	13.2	30.5[‡]
Race/ethnicity						
White NH	45.9	58.9	51.6	29.1	12.6	39.4
Black NH	42.4	56.4	50.4	21.1	12.4	31.6
Hispanic	42.9	54.9	54.7	15.8[§]	10.6	21.9[‡]
Education						
<12 yr	33.6	51.6	43.6	20.6	8.6	27.7
HS graduate	49.0	59.1	54.6	29.6	12.1	38.5
>12 yr	59.8[†]	71.1[†]	60.4[†]	37.2[†]	20.6[†]	53.7[†]
Household income						
<20,000	37.5	51.9	46.0	22.2	10.7	30.3
≥20,000	57.5[†]	69.4[†]	60.9[†]	35.6[†]	15.4[§]	48.3[†]
Currently married						
Yes	56.2	68.5	60.7	31.4	14.9	44.8
No	37.8[†]	52.0[†]	45.3[†]	23.4[†]	9.9[‡]	29.3[†]

Mam, mammography; CBE, clinical breast examination; DRE, digital rectal examination; FOBT, fecal occult blood test (within last 2 yr); PRSIG, proctosigmoidoscopy (within last 3 yr). [Persons receiving the exam for a health problem were excluded.] NH, nonHispanic; NA, not assessed.

Note: Persons with military health care coverage excluded (n = 188). Persons of other or unknown race excluded (n = 220 for ages 40–64, n = 30 for age 65+).

[*] Pap smear includes women 18–64 yr of age.

Overall chi-square tests for homogeneity in proportion screened across categories of each variable:

[†] $P < 0.001$.

[‡] $P < 0.01$.

[§] $P < 0.05$.

1990s, the for-profit independent practice associations (IPAs), and "managed fee-for-service" delivery systems such as preferred or exclusive provider organizations (PPOs or EPOs). These plans more closely resemble FFS delivery systems in terms of organization and delivery of services and now comprise a larger share of managed care enrollment than traditional prepaid group and staff model HMOs.[13,36]

In a subgroup analysis suggested by a reviewer, we examined differences in screening use among persons in four different types of managed care plans: group or staff model HMOs, network or Independent Practice Association (IPA), Preferred Provider Organizations (PPO), and mixed plans or other nonidentifiable plans. We found no consistent pattern of differences in the use of cancer screening among these four groups. However, this subgroup analysis was limited by a small sample size (n = 1,106 persons in managed care plans aged 40 years and older) and the inability to identify the specific type of plan for 46% of managed care enrollees who were grouped in the "mixed or other" category. To adequately address the question of differences according to type of managed care plan, a more focused, detailed data collection effort is required. Given the recent trends in the evolution of the health care system, research should seek to identify the specific organizational or financial features across diverse health plans that may be conducive to maximizing the delivery of cancer screening services.

TABLE 3. Unadjusted Estimates of Screening Use (% Weighted to US Total Population) According to Type of Health Insurance Coverage, 1992 NHIS

	Mam ($n = 2{,}093$)	CBE ($n = 2{,}130$)	Pap* ($n = 4{,}794$)	FOBT ($n = 3{,}753$)	PRSIG ($n = 3{,}858$)	DRE ($n = 3{,}593$)
Ages 40–64 yr						
Managed care	67.4	78.6	85.2	25.7	8.2	45.0
Private FFS	60.1	74.8	81.8	21.4	8.3	39.8
Medicaid (FFS)	39.9	57.9	82.3	17.8	6.9	25.8
No coverage	28.3	50.3	65.9	7.7	4.3	15.2
All combined	56.1	71.2	79.9	20.3	7.7	36.9
	Mam ($n = 1{,}282$)	CBE ($n = 1{,}289$)	Pap ($n = 1{,}321$)	FOBT ($n = 1{,}922$)	PRSIG ($n = 1{,}915$)	DRE ($n = 1{,}808$)
Ages 65+ yr						
Medicare + managed care	62.4	65.8	66.0	39.8	15.4	47.1
Medicare + FFS	47.9	63.4	54.6	29.8	13.5	41.6
Medicare + Medicaid	27.5	43.9	38.7	10.2	7.2	15.1
Medicare only	27.8	40.5	32.5	14.9	8.8	24.0
All combined	45.4	58.6	51.8	27.9	12.7	38.1

Mam, mammography; CBE, clinical breast examination; DRE, digital rectal examination; FOBT, fecal occult blood test (within last 2 yr); PRSIG, proctosigmoidoscopy (within last 3 yr); FFS, fee-for-service. [Persons receiving the exam for a health problem were excluded for that particular exam.]

Note: Overall chi-square tests for homogeneity across health coverage categories within each screening examination were significant at the $P < 0.01$ level, with exception of PRSIG in 40–64-year-olds ($P = 0.02$). Persons with military health care coverage or missing insurance coverage excluded ($n = 226$).

*Pap smear includes women ages 18–64 yr.

Differences among all four coverage groups may be shrinking for breast and cervical cancer screening for other reasons. Legislation in at least 42 states now mandates coverage of mammography screening by all private health insurers.[37,38] The generally high use of cervical and breast screening by women with Medicaid relative to those with private FFS coverage may be due in part to the Federal commitment to promote breast and cervical screening through state health departments.[39] Medicaid and Medicare initiated coverage of Pap smear and mammography for screening purposes in 1990 and 1991, respectively, and by 1991, Medicaid had extended coverage for Pap smears in 49 states.[40] In addition, Medicaid covers annual Pap smears for women in family planning programs and for those receiving prenatal services (personal communication, Medicaid Bureau, HCFA).

Unlike previous studies, this analysis took into account differences among health coverage groups by age, educational status, race, income, marital status, and self-reported health status, which also have been shown to be associated with cancer screening.[6,41–44] This study also incorporated an important refinement in the method of classifying respondents according to health coverage in the 1992 NHIS. Multiple survey items were used to ascertain specific plan names and features of coverage, in contrast to relying on a single item asking for the "usual source" of care used in an earlier analysis of the 1987 NHIS.[7]

There are limitations to our analysis. Because some persons may choose to enroll in managed care plans because they wish to obtain screening, causal inferences about the effects of coverage on use of cancer screening tests need to be interpreted with caution. Second, our measures of education and income may not have entirely captured the confounding of socioeconomic status on the association between health coverage and

TABLE 4. Adjusted Estimates of Percent Screened and 95% Confidence Intervals (Weighted to US Total Population) According to Type of Health Insurance Coverage, 1992 NHIS

	Mam	CBE	Pap*	FOBT	PRSIG	DRE
Ages 40–64 yr						
1. Managed care	64.2 (58.9–69.5)	77.1 (72.0–82.2)	83.5 (80.6–86.3)	25.4 (22.0–28.9)	7.7 (5.7–9.8)	43.6 (39.6–47.7)
2. Private FFS	58.2 (54.8–61.6)	74.4 (71.3–77.5)	80.2 (78.1–82.3)	20.2 (18.1–22.3)	7.8 (6.5–9.1)	37.8 (35.2–40.4)
3. Medicaid (FFS)	54.1 (44.3–63.8)	64.7 (53.4–76.1)	87.8 (84.4–91.2)	22.2 (14.5–30.0)	9.2 (3.9–14.6)	37.8 (28.8–46.8)
4. No coverage	34.3 (27.4–41.2)	54.0 (46.7–61.4)	70.3 (66.2–74.4)	9.4 (5.8–13.0)	5.3 (2.7–7.9)	18.8 (14.1–23.4)
Statistical comparisons†						
Managed care vs FFS (1 vs 2):	NS	NS	NS	$P < 0.001$	NS	$P = 0.01$
Extent of FFS insurance (2 vs 3):	NS	NS	$P < 0.001$	NS	NS	NS
(3 vs 4):	$P < 0.001$	$P = 0.04$	$P < 0.001$	$P < 0.001$	NS	$P < 0.001$
Ages 65+ yr						
1. Medicare + managed care	59.1 (50.6–67.6)	61.8 (53.2–70.3)	61.3 (52.8–69.9)	37.9 (30.9–45.0)	14.0 (9.1–18.9)	44.6 (37.7–51.5)
2. Medicare + FFS	47.8 (43.6–52.0)	64.1 (60.7–67.6)	54.7 (50.5–58.9)	29.7 (26.4–33.0)	13.5 (11.3–15.6)	40.6 (37.0–44.3)
3. Medicare + Medicaid	34.3 (24.2–44.3)	48.6 (38.3–58.9)	43.2 (32.8–53.7)	13.5 (6.0–21.1)	8.7 (3.1–14.4)	21.4 (12.8–30.0)
4. Medicare only	28.8 (22.5–35.0)	41.4 (33.7–49.0)	35.5 (28.6–42.5)	17.7 (12.7–22.7)	10.1 (6.5–13.8)	29.4 (23.3–35.5)
Statistical comparisons†						
Managed care vs FFS (1 vs 2):	$P = 0.02$	NS	NS	$P = 0.02$	NS	NS
Extent of FFS insurance (2 vs 3):	$P = 0.013$	$P = 0.007$	$P = 0.05$	$P = 0.003$	NS	$P < 0.001$
(3 vs 4):	NS	NS	NS	NS	NS	NS

Mam, mammography; CBE, clinical breast examination, DRE, digital rectal examination; FOBT, fecal occult blood test (within last 2 yr); PRSIG, proctosigmoidoscopy (within last 3 yr); NS, not significant; FFS, fee-for-service.

Note: All percentages estimated from logistic regression models adjusting for age (continuous); race/ethnicity (white nonhispanic, black nonhispanic, hispanic, unknown); gender (where applicable); educational attainment (<12 yr, HS graduate, >12 yr), annual family income (≤20,000 >20,000), marital status (currently married, not currently), and self-reported overall health status (excellent/very good, good, fair/poor). See Appendix B for odds ratios from logistic models. Joint tests for homogeneity of proportions across all categories of health care coverage, within each screening examination, were statistically significant at the $P < 0.001$ level, except for PRSIG in both age groups ($P > 0.05$).

[*] Includes women ages 18–64 yr.

[†] Statistical comparisons are based on tests of the logistic regression model coefficients.

screening. In particular, the use of a dichotomous income variable, necessary because of missing data for the more detailed income variable collected in the NHIS, may be an important source of unmeasured differences in socioeconomic status. We were unable to account for unmeasured confounding factors such as health-seeking behavior and attitudes toward screening. Fourth, the low prevalence of some of the screening tests may have made detection of statistically significant differences more difficult. The use of FOBT and DRE, and sigmoidoscopy in particular, were generally low because of scientific uncertainty about the efficacy of screening for colorectal and prostate cancer.[45–47] Finally, although self-report of most screening procedures is generally accurate relative to medical record audits, there may have been overreporting for some exams.[48,49]

In our "what-if" modeling exercise, we estimated that if Medicaid coverage were extended to the uninsured population, the percentage of uninsured women aged 40 to 64 years receiving mammography every 2 years would increase from 28% to 45%, whereas the percentage receiving Pap smear screening every 3 years would increase from 66% to 85% among women aged 18 to 64 years. If policies to enroll all currently uninsured women in managed care were implemented, it is estimated that Pap smear screening would increase from 66% to 80% and that mammography would increase from 28% to 52%. Investigations of breast and cervical cancer screening, however, including one comparative study of the United States and Ontario, have concluded that substantial improvements in screening rates are not likely through changes in health care coverage alone.[27,50] Our study lends support to the notion that programs or policies to improve adherence to recommended cancer screening examinations must address the complex interaction of sociodemographic, financial, and organizational characteristics that continue to influence screening rates. The relatively high use of breast and cervical cancer screening among younger women in the Medicaid Program deserves further study to help illuminate what works in stimulating the dissemination of cancer screening.

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References

1. **Manning WG, Leibowitz A, Goldberg GA, Rogers WH, Newhouse JP.** A controlled trial of the effect of a prepaid group practice on use of services. N Engl J Med 1984;310:1505.

2. **Lohr KN, Brook RH, Kamberg CJ, et al.** Use of medical care in the Rand Health Insurance Experiment. Diagnosis- and service-specific analyses in a randomized controlled trial. Med Care 1986;24 (Suppl):S1.

3. **Rasell ME.** Sounding board: Cost sharing in health insurance—a re-examination (editorial). N Engl J Med 1995;332:1164.

4. **Hopkins RS.** Insurance coverage and usage of preventive health services. J Fla Med Assoc 1993;80:529.

5. **Miller RH, Luft HS.** Managed care plan performance since 1980. A literature analysis. JAMA 1994;271:1512.

6. **Riley GF, Potosky AL, Lubitz JD, Brown ML.** Stage of cancer at diagnosis for Medicare HMO enrollees. Am J Public Health 1994;84:1598.

7. **Bernstein AB, Thompson GB, Harlan LC.** Differences in rates of cancer screening by usual source of medical care. Data from the 1987 National Health Interview Survey. Med Care 1991;29:196.

8. **Retchin SM, Brown B.** The quality of ambulatory care in Medicare health maintenance organizations [see comments]. Am J Public Health 1990;80:411.

9. **Woolhandler S, Himmelstein DU.** Reverse targeting of preventive care due to lack of health insurance. JAMA 1988;259:2872.

10. **Makuc DM, Freid VM, Parsons PE.** Health insurance and cancer screening among women. Adv Data 1994;254:1.

11. **Blustein J.** Medicare coverage, supplemental insurance, and the use of mammography by older women. N Engl J Med 1995;332:1138.

12. **Parker SL, Tong T, Bolden S, Wingo PA.** Cancer statistics, 1997. CA Cancer J Clin 1997;47:5.

13. **National Center for Health Statistics.** Health United States 1994. Hyattsville, MD: Department of Health and Human Services, 1995.

14. **Kletke PR, Emmons DW, Gillis KD.** Current trends in physicians' practice arrangements. JAMA 1996;276:555.

15. **American Cancer Society.** Mammography guidelines 1983: Background statement and update of cancer-related checkup guidelines for breast cancer detection in asymptomatic women age 40–49. CA Cancer J Clin 1983;33:255.

16. **Mettlin C, Jones GW, Averette H, Murphy GP.** Defining and updating the American Cancer Society guidelines for the cancer-related check-up: Prostate and endometrial cancers. CA Cancer J Clin 1993;43:42.

References

G, Leibowitz A, Goldberg GA,
ouse JP. A controlled trial of the ef-
p practice on use of services. N Engl

ook RH, Kamberg CJ, et al. Use of
Rand Health Insurance Experiment.
ice-specific analyses in a random-
Med Care 1986;24 (Suppl):S1.

Sounding board: Cost sharing in
re-examination (editorial). N Engl J

Insurance coverage and usage of
vices. J Fla Med Assoc 1993;80:529.

ft HS. Managed care plan perform-
ature analysis. JAMA 1994;271:1512.

osky AL, Lubitz JD, Brown ML.
diagnosis for Medicare HMO en-
ealth 1994;84:1598.

, Thompson GB, Harlan LC. Dif-
ancer screening by usual source of
m the 1987 National Health Inter-
e 1991;29:196.

Brown B. The quality of ambula-
health maintenance organizations
ublic Health 1990;80:411.

S, Himmelstein DU. Reverse tar-
ng due to lack of health insurance.

ef VM, Parsons PE. Health insur-
ening among women. Adv Data

dicare coverage, supplemental in-
f mammography by older women.
2:1138.

g T, Bolden S, Wingo PA. Cancer
ncer J Clin 1997;47:5.

ter for Health Statistics. Health
Hyattsville, MD: Department of
rvices, 1995.

mmons DW, Gillis KD. Current
' practice arrangements. JAMA

ncer Society. Mammography
ground statement and update of
p guidelines for breast cancer de-
ic women age 40–49. CA Cancer J

es GW, Averette H, Murphy GP.
g the American Cancer Society
er-related check-up: Prostate and
A Cancer J Clin 1993;43:42.

---

17. **DiGuiseppi C, Atkins D, Woolf SH, eds.** Guide to Clinical Preventive Services: Report of the US Preventive Services Task Force. 2nd edition. Baltimore, MD: Williams & Wilkins, 1996.

18. **Shapiro S, Venet W, Strax P, Venet L, Roeser R.** Ten- to fourteen-year effect of screening on breast cancer mortality. J Nat'l Ca Inst 1982;69:349.

19. **Guzick DS.** Efficacy of screening for cervical cancer: A review. Am J Public Health 1978;68:125.

20. **Johannesson G, Geirsson G, Day N.** The effect of mass screening in Iceland, 1965–1974, on the incidence and mortality of cervical carcinoma. Int J Cancer 1978;21:418.

21. **Mandel JS, Bond JH, Church TR, et al.** Reducing mortality from colorectal cancer by screening for fecal occult blood: Minnesota colon cancer control study. N Engl J Med 1993;328:1365.

22. **Benson V, Marano MA.** Current estimates from the National Health Interview Survey, 1992. Vital Health Stat 10 1994;1.

23. **Korn EL, Graubard BI.** Predictive margins with survey data. Proceedings of the Section on Survey Research Methods. American Statistical Association, 1997.

24. **Shah BV, Barnwell BG, Bieler GS.** SUDAAN user's manual. Release 7.0. Research Triangle Park, NC: Research Triangle Institute, 1996.

25. **Brook RH, Ware JE Jr, Rogers WH, et al.** Does free care improve adults' health? Results from a randomized controlled trial. N Engl J Med 1983;309:1426.

26. **Kirkman-Liff B, Kronenfeld JJ.** Access to cancer screening services for women. Am J Public Health 1992;82:733.

27. **Zapka JG, Stoddard A, Maul L, Costanza ME.** Interval adherence to mammography screening guidelines. Med Care 1991;29:697.

28. **Zapka JG, Hosmer D, Costanza ME, Harris DR, Stoddard A.** Changes in mammography use: Economic, need, and service factors. Am J Public Health 1992;82:1345.

29. **Ayanian JZ, Kohler BA, Abe T, Epstein AM.** The relation between health insurance coverage and clinical outcomes among women with breast cancer. N Engl J Med 1993;329:326.

30. **Selby JV, Friedman GD.** Sigmoidoscopy in the periodic health examination of asymptomatic adults. JAMA 1989;261:595.

31. **Selby JV, Friedman GD, Quesenberry CP, Weiss NS.** Effect of fecal occult blood testing on mortality from colorectal cancer. Ann Intern Med 1993;118:1.

32. **Selby JV, Friedman GD, Quesenberry CP Jr, Weiss NS.** A case-control study of screening sigmoidoscopy and mortality from colorectal cancer [see comments]. N Engl J Med 1992;326:653.

33. **McBride CM, Curry SJ, Taplin S, Anderman C, Grothaus L.** Exploring environmental barriers to participation in mammography screening in an HMO. Cancer Epidemiol Biomarkers Prev 1993;2:599.

34. **Trock B, Rimer BK, King E, Balshem A, Cristinzio CS, Engstrom PF.** Impact of an HMO-based intervention to increase mammography utilization. Cancer Epidemiiol Biomarkers Prev 1993;2:151.

35. Prevention and managed care: Opportunities for managed care organizations, purchasers of health care, and public health agencies. MMWR 1995;44:1.

36. **Marion Merrell Dow.** Managed care digest (HMO edition). Kansas City, MO: Marion Merrell Dow, 1992.

37. **Calder K.** Access to screening mammography: Patient concerns about insurance. Womens Health Issues 1992;2:189.

38. **McKinney MM, Marconi KM.** Legislative interventions to increase access to screening mammography. J Community Health 1992;17:333.

39. Update: National breast and cervical cancer: Early detection program, 1992–1993. MMWR 1993;42:747.

40. **Boss LP, Guckes FH.** Medicaid coverage of screening tests for breast and cervical cancer. Am J Public Health 1992;82:252.

41. **Wells BL, Horm JW.** Stage at diagnosis in breast cancer: Race and socioeconomic factors. Am J Public Health 1992;82:1383.

42. **Dawson DA, Thompson GB.** Breast cancer risk factors and screening: United States, 1987. Vital Health Stat 10 1989:1.

43. **Brown ML, Potosky AL, Thompson GB, Kessler LG.** The knowledge and use of screening tests for colorectal and prostate cancer: Data from the 1987 National Health Interview Survey. **Prev Med** 1990;19:562.

44. **Mandelblatt J, Andrews H, Kerner J, Zauber A, Burnett W.** Determinants of late stage diagnosis of breast and cervical cancer: The impact of age, race, social class, and hospital type. Am J Public Health 1991;81:646.

45. **Mandel JS, Ederer F, Church T, Bond J.** Screening for colorectal cancer: Which test is best? JAMA 1994;272:1099.

46. **Lang CA, Ransohoff DF.** Fecal occult blood screening for colorectal cancer: Is mortality reduced by chance selection for screening colonoscopy. JAMA 1994;271:1011.

47. **Kramer BS, Brown ML, Prorok PC, Potosky AL, Gohagan JK.** Prostate cancer screening: What we know and what we need to know. Ann Intern Med 1993;119:914.

48. **Gordon NP, Hiatt RA, Lampert DI.** Concordance of self-reported data and medical record audit for six cancer screening procedures. J Natl Cancer Inst 1993;85:566.

49. **Sudman S, Warnecke R, Johnson T, O'Rourke D, Davis AM.** Cognitive aspects of reporting cancer examinations and tests. Vital Health Stat Series 6 1994:1–20.

50. **Katz SJ, Hofer TP.** Socioeconomic disparities in preventive care persist despite universal coverage: Breast and cervical cancer screening in Ontario and the US. JAMA 1994;272:530.

Appendix A.
Items from 1992 NHIS Used to Evaluate Screening and Health Care Coverage

I. Evaluation of screening: Cancer Control Supplement to the 1992 NHIS.

For each of the 6 cancer screening exams, the following survey items were used to ascertain screening history:

Have you ever heard of a ____________? (A short description is then provided of the screening exam or procedure)

Have you ever had a ____________?

When did you have your most recent ____________?

(If I don't know): Was it within the past year, between 1 and 3 years ago, or over 3 years ago?

What was the main reason you had this ____________?

II. Evaluation of health care coverage: "Family Resources" section, 1992 NHIS.

1a. In (month), was anyone in the family covered by Medicare?

Similar items were used to identify coverage by Medicaid, CHAMPUS, CHAMPVA, VA, military health care, or other public assistance programs.

5a. Not counting Medicare, was anyone in the family covered by a health insurance plan that pays any part of hospital or doctor bills? Do NOT include plans that pay for ONLY ONE type of service, such as nursing home care or accidents.

5b. It's important that we have the complete and accurate name of your health insurance plan. What is the complete name of the plan? (If "don't know") – Do you have something with the plan name on it?

5c. Is anyone in the family now covered by any OTHER health insurance plan?

For each plan:

6a. Is this (name) plan a health maintenance organization or HMO?

6b. DOES this plan allow you to choose any physician or does it require you to choose a physician from a group of selected physicians?

6c. Was this plan obtained through an employer or union?

6d. DOES the employer or union pay for all, some, or none of the premium?

7. Is (name of each family member) covered under this (name) plan?

Note: To verify HMO plans, each plan name ascertained in 5b was compared against an independently developed, comprehensive listing of all HMO and PPO plans operating in the US in 1991-92, from sources including Health Care Financing Administration, Interstudy, and Group Health Association of America (now named American Association of Health Plans).

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Appendix B.
Logistic Regression Model Results (Odds Ratios) for Effects of Health Coverage and Other Characteristics on Use of Screening Tests

	Mam (*n* = 2040)	CBE (*n* = 2075)	Pap (*n* = 4699)	FOBT (*n* = 3674)	PRSIG (*n* = 3772)	DRE (*n* = 3510)
Persons less than age 65						
Health insurance coverage						
No coverage	0.27*	0.33*	0.43*	0.29*	0.65	0.28*
Medicaid (FFS)	0.67	0.57	1.56‡	0.83	1.22	0.77
Private FFS	0.76	0.85	0.79	0.73†	1.00	0.77†
Managed care	1.00	1.00	1.00	1.00	1.00	1.00
Age (continuous)	1.02‡	0.98	0.98*	1.07*	1.08*	1.03*
Race/Ethnicity						
Black non-Hispanic	0.97	1.06	2.02*	1.03	1.60	0.80
Hispanic	1.65†	1.60	1.30	0.82	1.22	0.67‡
Other/unknown	0.55	0.32†	0.36*	0.67	0.36‡	0.49‡
White non-Hispanic	1.00	1.00	1.00	1.00	1.00	1.00
Education						
More than 12 years	2.32*	2.05*	3.34*	2.13*	2.38*	2.03*
HS graduate	1.42‡	1.29	1.56†	1.30	1.23	1.35
Less than 12 years	1.00	1.00	1.00	1.00	1.00	1.00
Annual family income						
More or equal to 20K	1.47†	1.28	1.14	1.26	1.37	1.56*
Less than 20K	1.00	1.00	1.00	1.00	1.00	1.00
Marital status						
Currently married	1.01	1.12	2.04*	1.31‡	1.13	1.08
Not married	1.00	1.00	1.00	1.00	1.00	1.00
Overall health status						
Fair/poor	0.69‡	1.23	0.84	1.23	1.13	1.01
Good	0.90	0.99	0.97	1.01	1.06	1.05
Excellent/very good	1.00	1.00	1.00	1.00	1.00	1.00
Gender						
Male	NA	NA	NA	0.90	1.68*	0.56*
Female	NA	NA	NA	1.00	1.00	1.00

(Continues)

Appendix B (*Continued*)

	Mam (*n* = 2040)	CBE (*n* = 2075)	Pap (*n* = 4699)	FOBT (*n* = 3674)	PRSIG (*n* = 3772)	DRE (*n* = 3510)
Persons ages 65 and over						
Health insurance coverage						
Medicare only	0.25*	0.41†	0.32*	0.34*	0.69	0.49*
Medicare + Medicaid (FFS)	0.32*	0.56	0.46†	0.25*	0.60	0.31†
Medicare + private FFS plan	0.61‡	1.12	0.75	0.68‡	0.96	0.84
Medicare + managed care plan	1.00	1.00	1.00	1.00	1.00	1.00
Age (continuous)	0.94*	0.94*	0.95*	0.99	1.02	0.98*
Race/Ethnicity						
Black non-Hispanic	1.55	1.33	1.36	0.95	1.44	1.23
Hispanic	1.19	1.20	1.40	0.61	1.46	0.63
Other/unknown	0.32‡	1.14	1.13	0.65	3.03‡	0.54
White non-Hispanic	1.00	1.00	1.00	1.00	1.00	1.00
Education						
More than 12 years	1.99*	1.55‡	1.41‡	1.61†	2.65*	2.21*
HS graduate	1.46‡	1.02	1.22	1.29	1.52‡	1.47†
Less than 12 years	1.00	1.00	1.00	1.00	1.00	1.00
Annual family income						
More than or equal to 20K	1.65†	1.61†	1.32	1.44‡	0.94	1.34‡
Less than 20K	1.00	1.00	1.00	1.00	1.00	1.00
Marital status						
Currently married	1.29	1.30	1.24	1.11	1.18	1.20
Not married	1.00	1.00	1.00	1.00	1.00	1.00
Overall health status						
Fair/poor	1.31	1.18	0.95	1.20	0.86	1.05
Good	1.24	1.03	1.09	0.95	0.97	1.16
Excellent/very good	1.00	1.00	1.00	1.00	1.00	1.00
Gender						
Male	NA	NA	NA	0.90	1.85*	1.59*
Female	NA	NA	NA	1.00	1.00	1.00

Mam, mammography; CBE, clinical breast examination; FOBT, fecal occult blood test; PRSIG, proctosigmoidoscopy; DRE, digital rectal exam; NA, not applicable.

Note: Mammography, CBE, DRE, and FOBT within past 2 years. Pap Smear (ages 18–64), and PRSIG within past 3 years.

P for *t* tests of significance: * = $P < 0.001$; † = $P < 0.01$; ‡ = $P < 0.05$.

Respondents with missing data on any of the independent variable were dropped from logistic regression models for that particular screening test.